

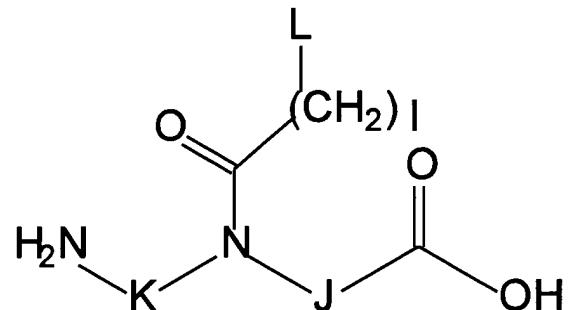
said peptide nucleic acid having a backbone;

said backbone having an amino end, a carboxyl end, a plurality of amino groups, and a conjugate bound directly or through a linking moiety to at least one of said amino end or said carboxyl end;

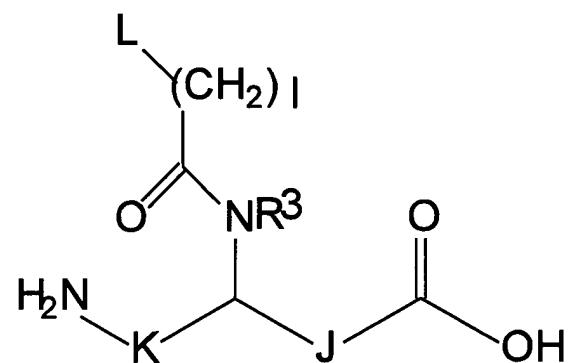
said amino groups each having a tethered nucleobase; and  
said conjugate being a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator;

wherein said crosslinking agent is not lysine.

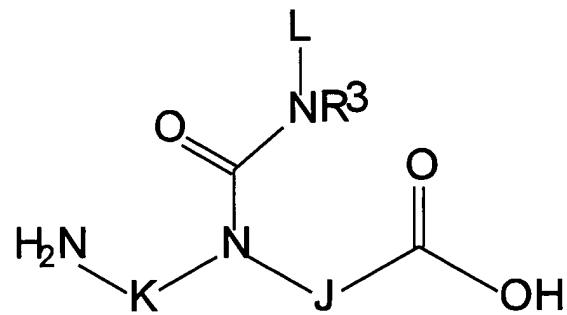
30. (Twice amended) A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

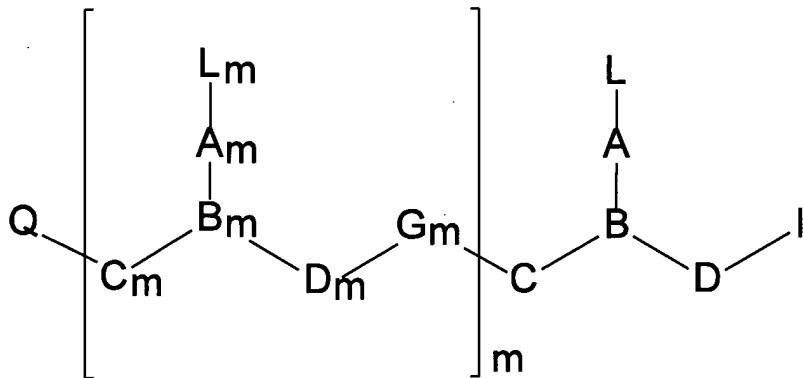
K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2-C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1-C_6$ ) alkoxy, ( $C_1-C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl; each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10; l is an integer from 1 to 5; and at least one of L and R3 comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; [and compare] wherein said conjugate optionally includes a linking moiety.

37. (Amended) A peptide nucleic acid conjugate of the formula:



wherein:

$m$  is an integer from 1 to about 50;

$L$  and  $L_m$  independently are  $R^{12}(R^{13})_a$  wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

$a$  is 0 or 1;

C and C<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup>, SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

wherein R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl; and

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino;

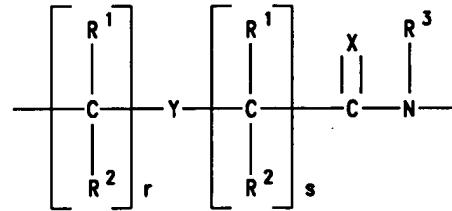
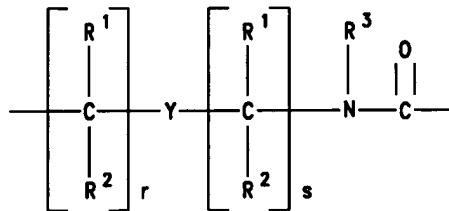
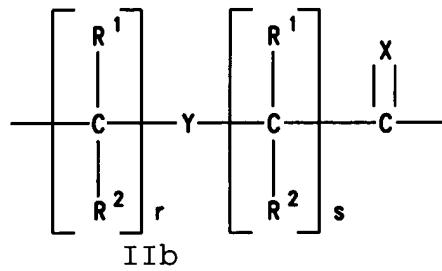
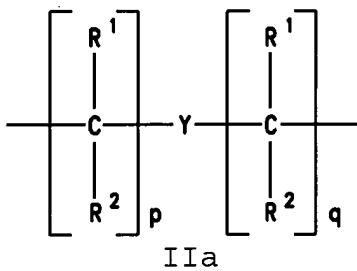
D and D<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>;

each of y and z is zero or an integer from 1 to 10, wherein the sum y + z is greater than 2 but not more than 10;

G<sub>m</sub> is independently -NR<sup>3</sup>CO-, -NR<sup>3</sup>CS-, -NR<sup>3</sup>SO-, or -NR<sup>3</sup>SO<sub>2</sub>- in either orientation;

each pair of A-A<sub>m</sub> and B-B<sub>m</sub> are selected such that:

- (a) A or A<sub>m</sub> is a group of formula (IIa), (IIb) or (IIc) and B or B<sub>m</sub> is N or R<sup>3</sup>N<sup>+</sup>; or
- (b) A or A<sub>m</sub> is a group of formula (IID) and B or B<sub>m</sub> is CH;



wherein:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a

nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate; Q is -CO<sub>2</sub>H, -CO<sub>2</sub>R<sup>8</sup>, -CO<sub>2</sub>R<sup>9</sup>, -CONR<sup>8</sup>R<sup>9</sup>, -SO<sub>3</sub>H, -SO<sub>2</sub>NR<sup>10</sup>R<sup>11</sup> or an activated derivative of -CO<sub>2</sub>H or -SO<sub>3</sub>H; and

wherein:

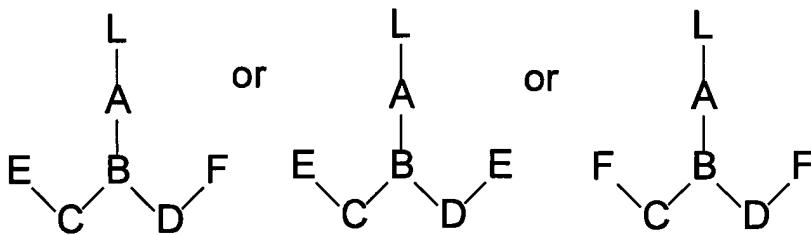
at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A<sub>m</sub>, L, and L<sub>m</sub> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein when said Q or I is a crosslinking agent, said crosslinking agent is not lysine.

38. (Amended) A compound having one of the following formulas:



wherein:

$L$  is  $R^{12}(R^{13})_a$ ; wherein:

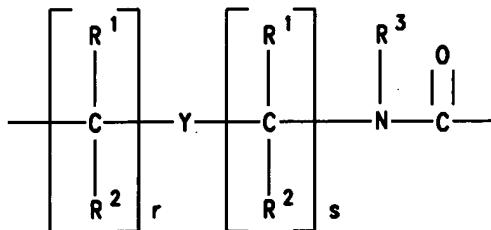
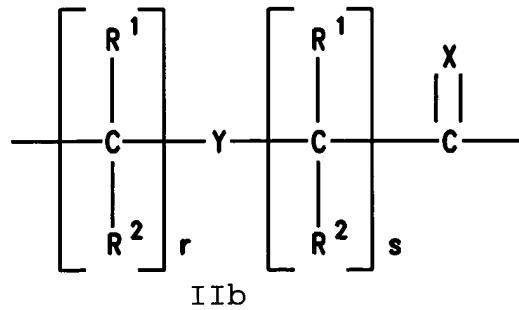
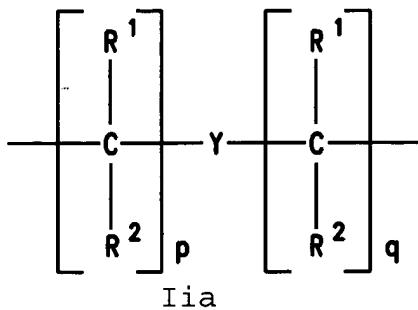
$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

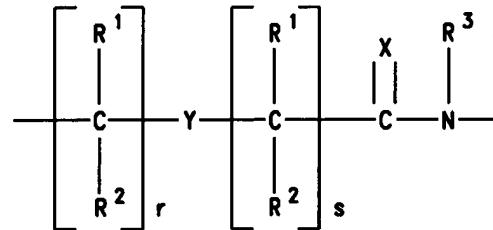
$a$  is 0 or 1;

$A$  and  $B$  are selected such that:

- (a)  $A$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  is  $N$  or  $R^3N^+$ ; or
- (b)  $A$  is a group of formula (IID) and  $B$  is  $CH$ ;



IIc



IID

where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group;

[wherein:] or

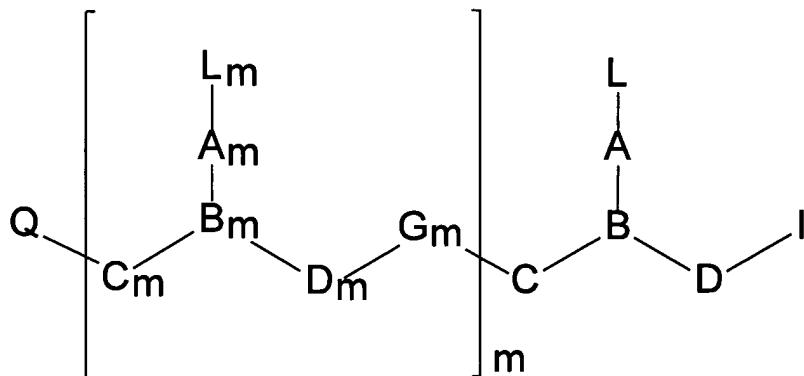
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a

carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety.

Please add new claims 39-49 as indicated below:

--39. A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer from 1 to about 50;

L and L<sub>m</sub> independently are R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub> wherein:

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA

intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R<sup>13</sup> is a conjugate; and

a is 0 or 1;

C and C<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup>, SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

wherein R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl; and

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio- substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino;

D and D<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>;

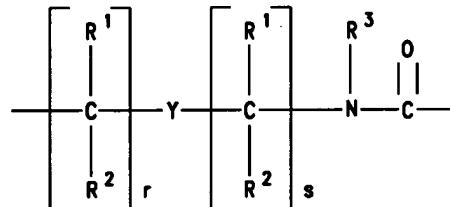
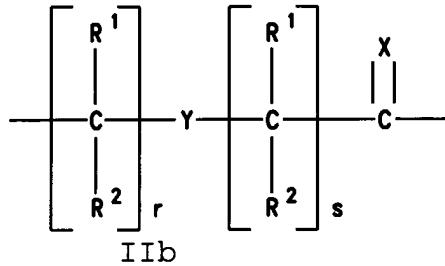
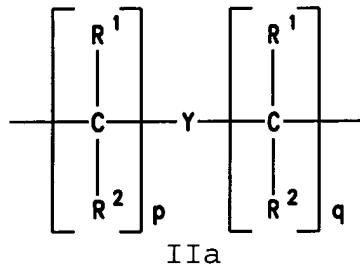
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

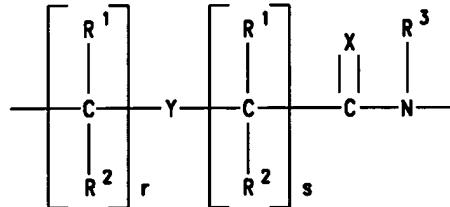
each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is N or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IID) and  $B$  or  $B_m$  is CH;



IIc



IID

wherein:

$X$  is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond, O, S or  $NR^4$ ;

each of  $p$  and  $q$  is zero or an integer from 1 to 5;

each of  $r$  and  $s$  is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is -CO<sub>2</sub>H, -CO<sub>2</sub>R<sup>8</sup>, -CO<sub>2</sub>R<sup>9</sup>, -CONR<sup>8</sup>R<sup>9</sup>, -SO<sub>3</sub>H, -SO<sub>2</sub>NR<sup>10</sup>R<sup>11</sup> or an activated derivative of -CO<sub>2</sub>H or -SO<sub>3</sub>H; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A<sub>m</sub>, L, and L<sub>m</sub> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving

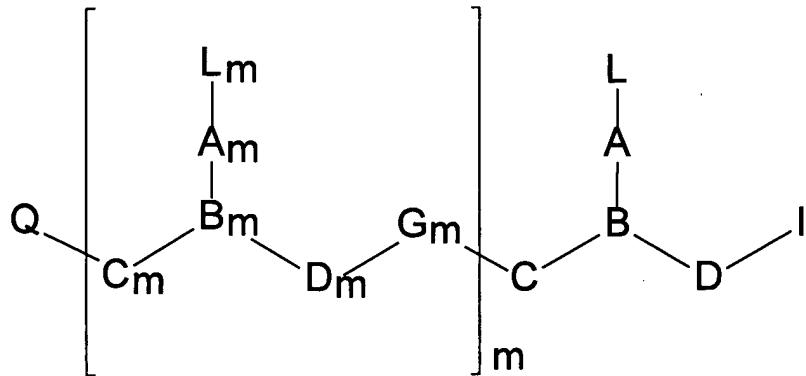
complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R<sup>1</sup>, R<sup>2</sup> or R<sup>3</sup> is a conjugate; and

wherein when said Q or I is a crosslinking agent, said crosslinking agnt is not lysine.

40. A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer from 1 to about 50;

L and L<sub>m</sub> independently are R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub> wherein:

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA

intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R<sup>13</sup> is a conjugate; and

a is 0 or 1;

C and C<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup>, SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

wherein R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl; and

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio- substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino;

D and D<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>;

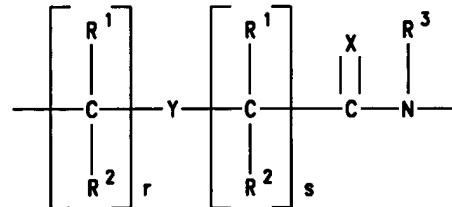
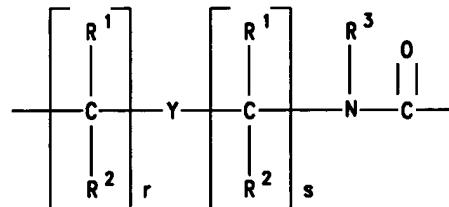
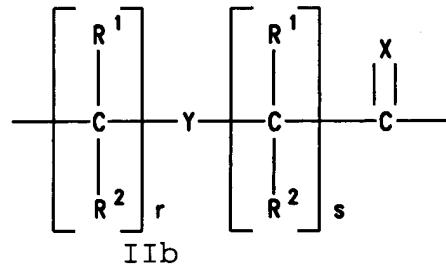
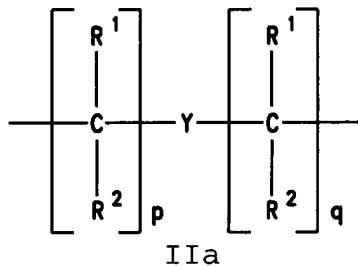
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is N or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IID) and  $B$  or  $B_m$  is CH;



IIc

IID

wherein:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is -CO<sub>2</sub>H, -CO<sub>2</sub>R<sup>8</sup>, -CO<sub>2</sub>R<sup>9</sup>, -CONR<sup>8</sup>R<sup>9</sup>, -SO<sub>3</sub>H, -SO<sub>2</sub>NR<sup>10</sup>R<sup>11</sup> or an activated derivative of -CO<sub>2</sub>H or -SO<sub>3</sub>H; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A<sub>m</sub>, L, and L<sub>m</sub> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving

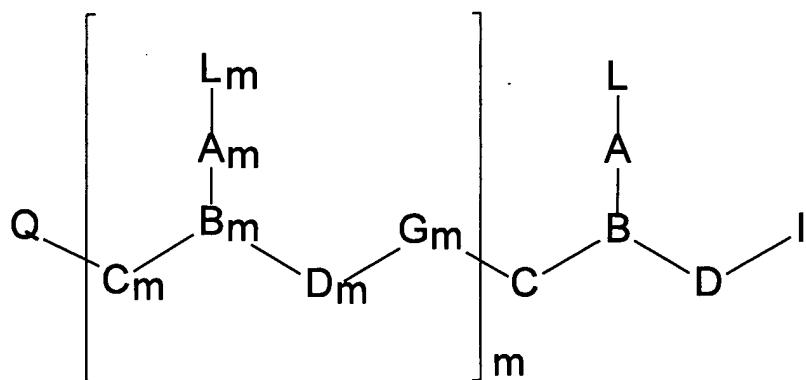
complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> is a conjugate, and

wherein when said Q or I is a crosslinking agent, said crosslinking agnt is not lysine.

41. A peptide nucleic acid conjugate of the formula:



wherein:

m is an integer from 1 to about 50;

L and L<sub>m</sub> independently are R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub> wherein:

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA

intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate; provided that at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

R<sup>13</sup> is a conjugate; and

a is 0 or 1;

C and C<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup>, SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

wherein R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl; and

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio- substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino;

D and D<sub>m</sub> independently are (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>;

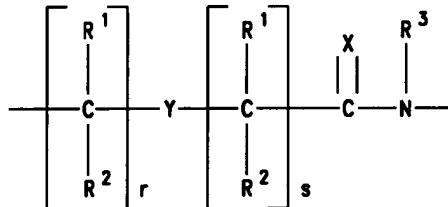
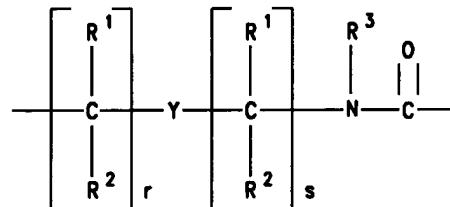
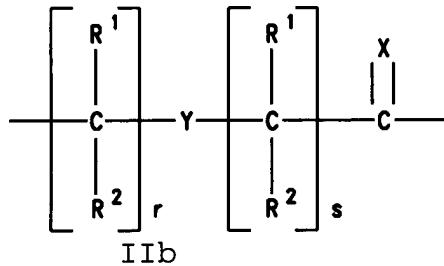
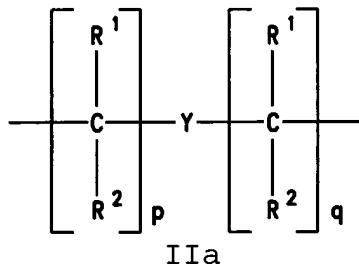
each of  $y$  and  $z$  is zero or an integer from 1 to 10, wherein the sum  $y + z$  is greater than 2 but not more than 10;

$G_m$  is independently  $-NR^3CO-$ ,  $-NR^3CS-$ ,  $-NR^3SO-$ , or  $-NR^3SO_2-$  in either orientation;

each pair of  $A-A_m$  and  $B-B_m$  are selected such that:

(a)  $A$  or  $A_m$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  or  $B_m$  is N or  $R^3N^+$ ; or

(b)  $A$  or  $A_m$  is a group of formula (IID) and  $B$  or  $B_m$  is CH;



IIc

IID

wherein:

X is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

Y is a single bond, O, S or  $NR^4$ ;

each of p and q is zero or an integer from 1 to 5;

each of r and s is zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

I is -NR<sup>8</sup>R<sup>9</sup> or -NR<sup>10</sup>C(O)R<sup>11</sup>; wherein:

R<sup>8</sup>, R<sup>9</sup>, R<sup>10</sup> and R<sup>11</sup> independently are hydrogen, alkyl, an amino protecting group, a reporter ligand, an intercalator, a chelator, a peptide, a protein, a carbohydrate, a lipid, a steroid, a nucleoside, a nucleotide, a nucleotide diphosphate, a nucleotide triphosphate, an oligonucleotide, an oligonucleoside, a soluble polymer, a non-soluble polymer or a conjugate;

Q is -CO<sub>2</sub>H, -CO<sub>2</sub>R<sup>8</sup>, -CO<sub>2</sub>R<sup>9</sup>, -CONR<sup>8</sup>R<sup>9</sup>, -SO<sub>3</sub>H, -SO<sub>2</sub>NR<sup>10</sup>R<sup>11</sup> or an activated derivative of -CO<sub>2</sub>H or -SO<sub>3</sub>H; and

wherein:

at least one of Q and I comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A, A<sub>m</sub>, L, and L<sub>m</sub> comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving

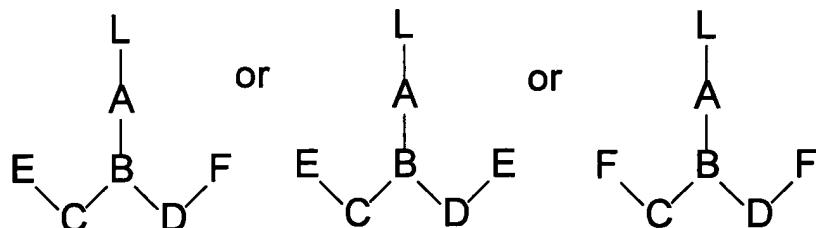
complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R<sup>3</sup> R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup> and R<sup>7</sup> is a conjugate; and

wherein when said Q or I is a crosslinking agent, said crosslinking agnt is not lysine.

42. A peptide nucleic acid conjugate of formula:



wherein:

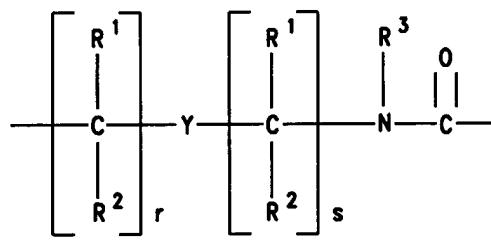
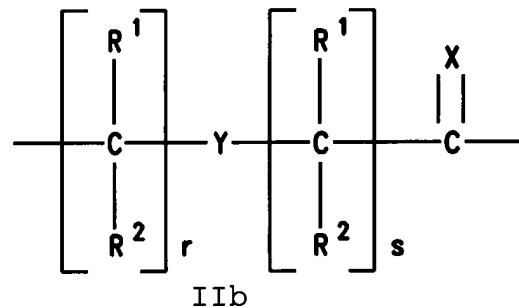
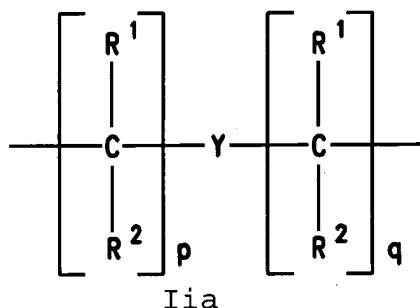
L is R<sup>12</sup> (R<sup>13</sup>)<sub>a</sub>; wherein:

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R<sup>12</sup>

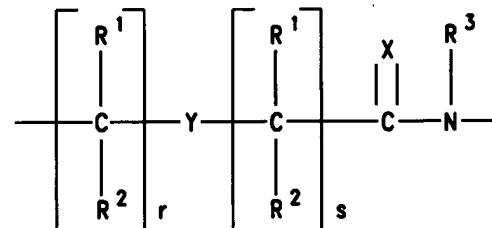
is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;  
 $R^{13}$  is a conjugate; and  
 $a$  is 0 or 1;

$A$  and  $B$  are selected such that:

- (a)  $A$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  is N or  $R^3N^+$ ; or
- (b)  $A$  is a group of formula (IId) and  $B$  is CH;



IIc



IId

where:

$X$  is O, S, Se,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond, O, S or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;  
r and s independently are zero or an integer from 1 to 5;  
 $R^1$  and  $R^2$  independently are hydrogen, ( $C_1$ - $C_4$ )alkyl, hydroxy-substituted ( $C_1$ - $C_4$ )alkyl, alkoxy-substituted ( $C_1$ - $C_4$ )alkyl, alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is  $(CR^6R^7)_y$ ;

D is  $(CR^6R^7)_z$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ )alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ )alkyl, hydroxy, alkoxy, alkylthio or amino; and  $R^5$  is hydrogen, a conjugate, ( $C_1$ - $C_6$ )alkyl, hydroxy-, alkoxy-, or alkylthio- substituted ( $C_1$ - $C_6$ )alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH,  $SO_2OH$  or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

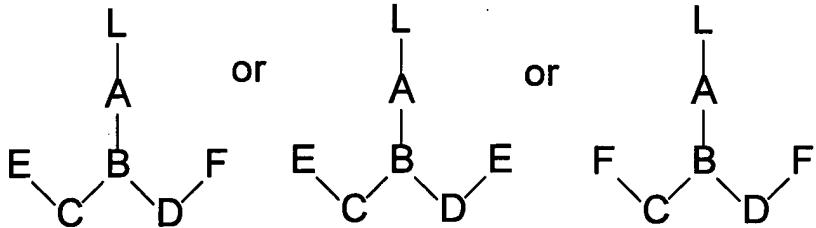
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety;

and

wherein at least one group R<sup>3</sup> is a conjugate.

43. A peptide nucleic acid conjugate of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

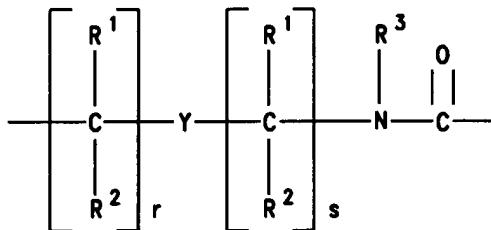
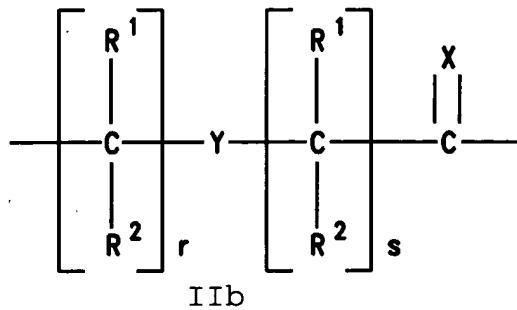
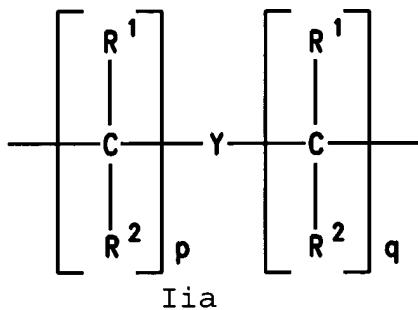
$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

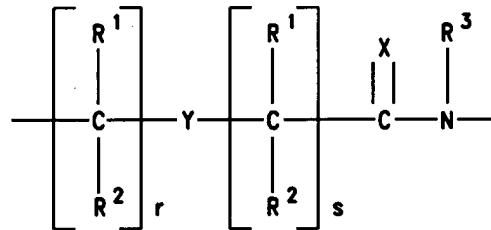
a is 0 or 1;

A and B are selected such that:

- (a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- (b) A is a group of formula (IID) and B is CH;



IIc



IID

where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

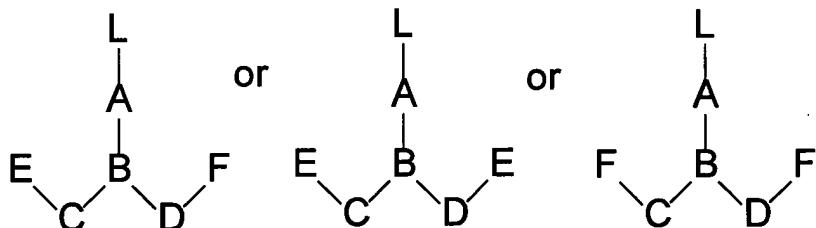
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a

phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said groups A or said groups B include a conjugate.

44. A peptide nucleic acid conjugate of formula:



wherein:

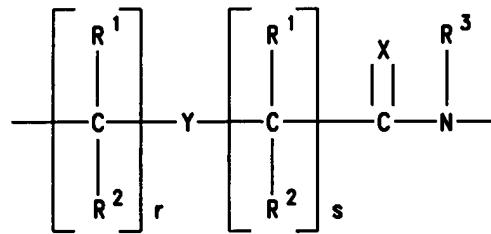
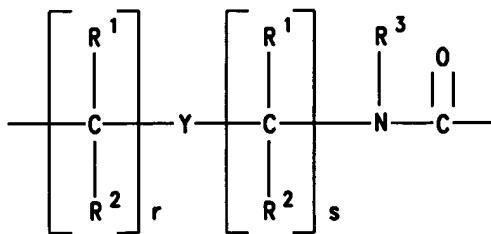
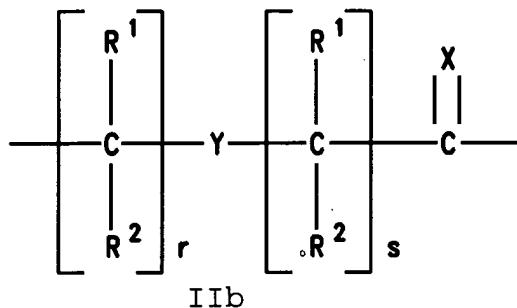
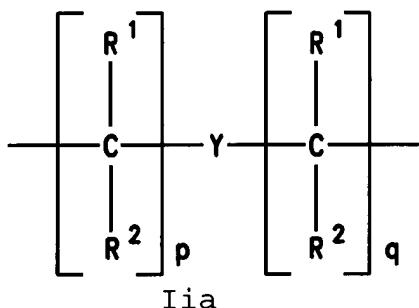
L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$

is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;  
 $R^{13}$  is a conjugate; and  
 $a$  is 0 or 1;

$A$  and  $B$  are selected such that:

- (a)  $A$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  is  $N$  or  $R^3N^+$ ; or
- (b)  $A$  is a group of formula (IID) and  $B$  is  $CH$ ;



where:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

p and q independently are zero or an integer from 1 to 5;  
r and s independently are zero or an integer from 1 to 5;  
 $R^1$  and  $R^2$  independently are hydrogen, ( $C_1$ - $C_4$ ) alkyl, hydroxy-substituted ( $C_1$ - $C_4$ ) alkyl, alkoxy-substituted ( $C_1$ - $C_4$ ) alkyl, alkylthio-substituted ( $C_1$ - $C_4$ ) alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is  $(CR^6R^7)_y$ ;

D is  $(CR^6R^7)_z$ ; wherein:

$R^6$  and  $R^7$  independently are hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2$ - $C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1$ - $C_6$ ) alkoxy, ( $C_1$ - $C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1$ - $C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1$ - $C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino; and  $R^5$  is hydrogen, a conjugate, ( $C_1$ - $C_6$ ) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted ( $C_1$ - $C_6$ ) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH,  $SO_2OH$  or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

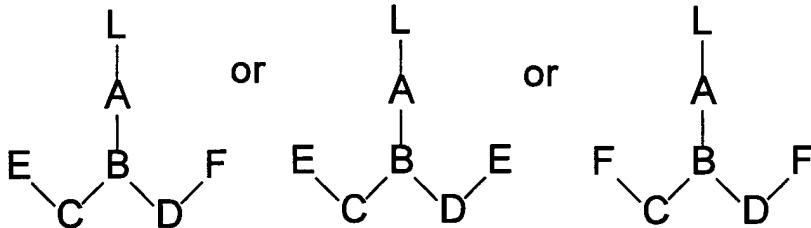
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety;

and

wherein at least one of group R<sup>1</sup> or group R<sup>2</sup> is a conjugate.

45. A peptide nucleic acid conjugate of formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

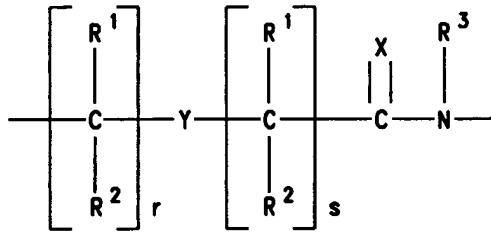
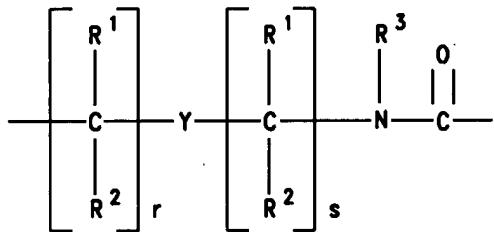
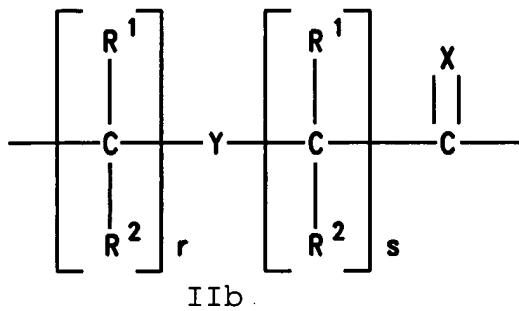
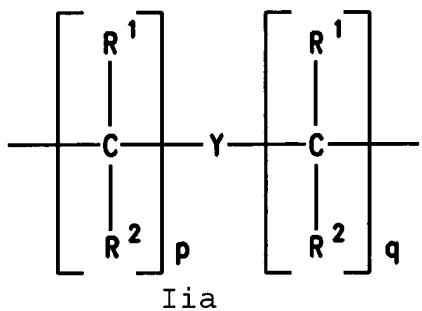
$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

A and B are selected such that:

- (a) A is a group of formula (IIa), (IIb) or (IIc) and B is N or  $R^3N^+$ ; or
- (b) A is a group of formula (IID) and B is CH;



where:

X is O, S, Se, NR<sup>3</sup>, CH<sub>2</sub> or C(CH<sub>3</sub>)<sub>2</sub>;

Y is a single bond, O, S or NR<sup>4</sup>;

p and q independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>) alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>) alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>) alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

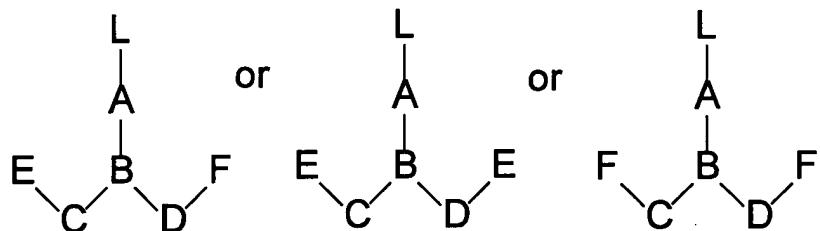
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a

phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety; and

wherein at least one of R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup>, and R<sup>7</sup> is a conjugate.

46. A peptide nucleic acid conjugate of formula:



wherein:

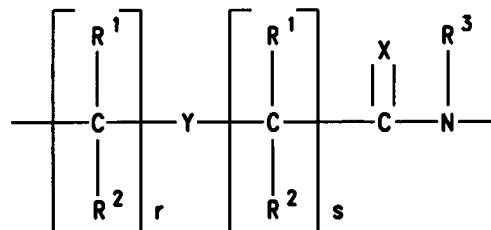
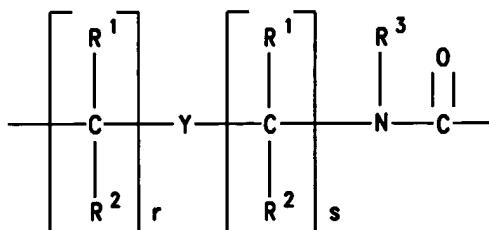
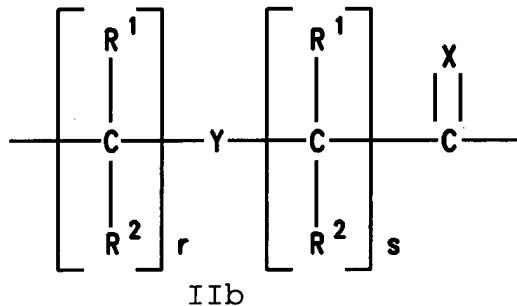
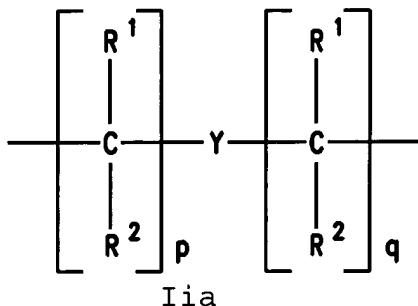
L is R<sup>12</sup>(R<sup>13</sup>)<sub>a</sub>; wherein:

R<sup>12</sup> is hydrogen, hydroxy, (C<sub>1</sub>-C<sub>4</sub>) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of R<sup>12</sup> is a naturally occurring nucleobase, a non-naturally

occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;  
 $R^{13}$  is a conjugate; and  
 $a$  is 0 or 1;

$A$  and  $B$  are selected such that:

- (a)  $A$  is a group of formula (IIa), (IIb) or (IIc) and  $B$  is  $N$  or  $R^3N^+$ ; or
- (b)  $A$  is a group of formula (IId) and  $B$  is  $CH$ ;



where:

$X$  is  $O$ ,  $S$ ,  $Se$ ,  $NR^3$ ,  $CH_2$  or  $C(CH_3)_2$ ;

$Y$  is a single bond,  $O$ ,  $S$  or  $NR^4$ ;

$p$  and  $q$  independently are zero or an integer from 1 to 5;

r and s independently are zero or an integer from 1 to 5;

R<sup>1</sup> and R<sup>2</sup> independently are hydrogen, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkoxy-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio, amino, halogen or a conjugate;

C is (CR<sup>6</sup>R<sup>7</sup>)<sub>y</sub>;

D is (CR<sup>6</sup>R<sup>7</sup>)<sub>z</sub>; wherein:

R<sup>6</sup> and R<sup>7</sup> independently are hydrogen, a side chain of a naturally occurring alpha amino acid, (C<sub>2</sub>-C<sub>6</sub>) alkyl, aryl, aralkyl, heteroaryl, hydroxy, (C<sub>1</sub>-C<sub>6</sub>) alkoxy, (C<sub>1</sub>-C<sub>6</sub>) alkylthio, a conjugate, NR<sup>3</sup>R<sup>4</sup> and SR<sup>5</sup> or R<sup>6</sup> and R<sup>7</sup> taken together complete an alicyclic or heterocyclic system;

R<sup>3</sup> and R<sup>4</sup> independently are hydrogen, a conjugate, (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy- or alkoxy- or alkylthio-substituted (C<sub>1</sub>-C<sub>4</sub>)alkyl, hydroxy, alkoxy, alkylthio or amino; and R<sup>5</sup> is hydrogen, a conjugate, (C<sub>1</sub>-C<sub>6</sub>)alkyl, hydroxy-, alkoxy-, or alkylthio- substituted (C<sub>1</sub>-C<sub>6</sub>)alkyl;

each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

E independently is COOH, CSOH, SOOH, SO<sub>2</sub>OH or an activated or protected derivative thereof;

F independently is NHR<sup>3</sup> or NPgR<sup>3</sup>, where Pg is an amino protecting group; or

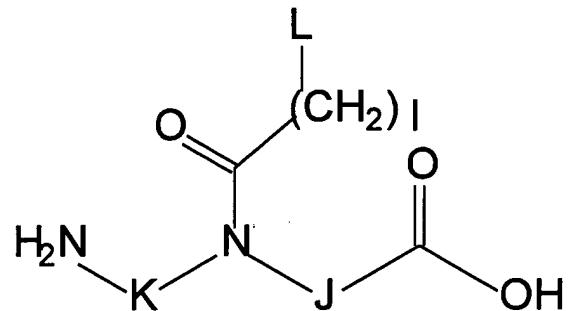
F comprises a conjugate selected from a terpene, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, a porphyrin, or an alkylator; or

at least one of A and L comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers; and wherein said conjugate optionally includes a linking moiety;

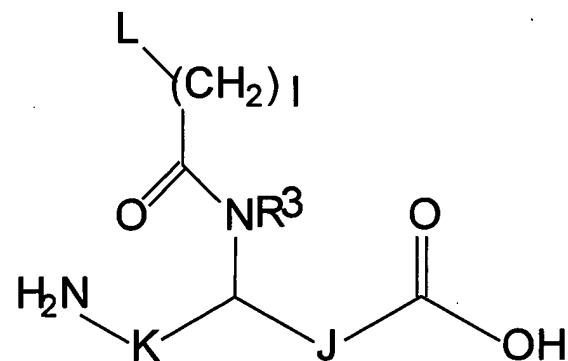
and

wherein at least one of said groups C or said groups D include a conjugate.

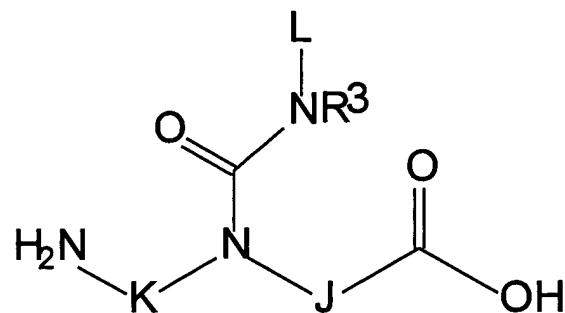
47. A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2-C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1-C_6$ ) alkoxy, ( $C_1-C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1-C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1-C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

$R^5$  is hydrogen, a conjugate, ( $C_1-C_6$ )alkyl, hydroxy-, alkoxy-, or alkylthio- substituted ( $C_1-C_6$ )alkyl; each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

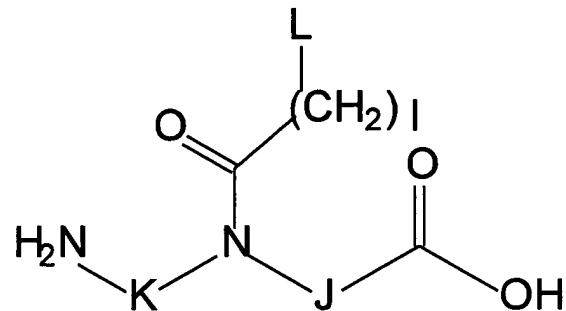
l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

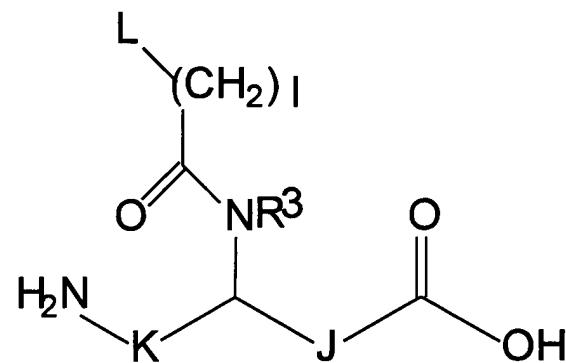
wherein said conjugate optionally includes a linking moiety; and

wherein at least one of  $R^3$ ,  $R^4$ ,  $R^5$ ,  $R^6$ , and  $R^7$  is a conjugate.

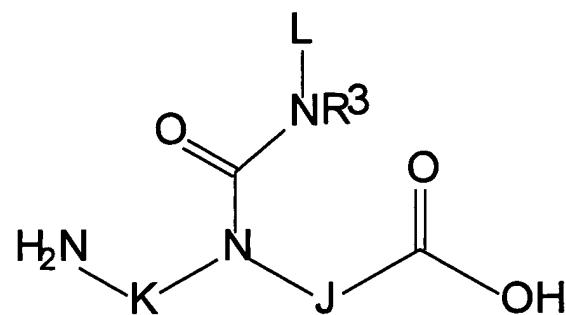
48. A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2-C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1-C_6$ ) alkoxy, ( $C_1-C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1-C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1-C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

$R^5$  is hydrogen, a conjugate,  $(C_1-C_6)$ alkyl, hydroxy-, alkoxy-, or alkylthio- substituted  $(C_1-C_6)$ alkyl; each of y and z is zero or an integer from 1 to 10, the sum y + z being greater than 2 but not more than 10;

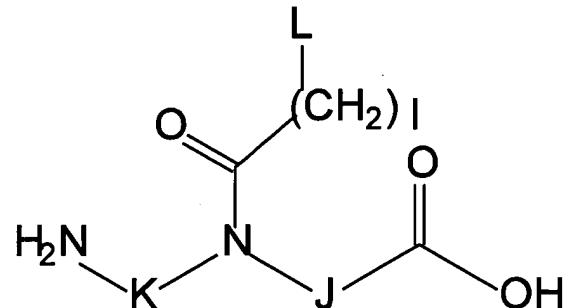
l is an integer from 1 to 5; and

at least one of L and R3 comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

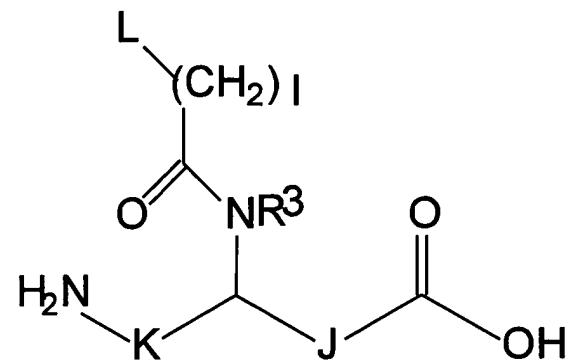
wherein said conjugate optionally includes a linking moiety; and

wherein at least one of said group K or said group J includes a conjugate.

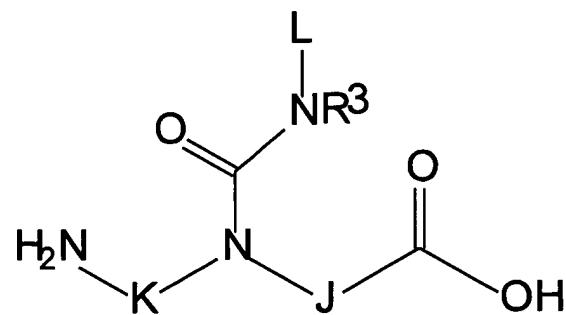
49. A peptide nucleic acid conjugate comprising a plurality of PNA monomers wherein at least one of said PNA monomers has the formula:



or formula:



or formula:



wherein:

L is  $R^{12}(R^{13})_a$ ; wherein:

$R^{12}$  is hydrogen, hydroxy, ( $C_1-C_4$ ) alkanoyl, a naturally occurring nucleobase, a non-naturally occurring nucleobase, an aromatic moiety, a DNA intercalator, a nucleobase-binding group, a heterocyclic moiety, a reporter ligand, or a conjugate and at least one of  $R^{12}$  is a naturally occurring nucleobase, a non-naturally occurring nucleobase, a DNA intercalator, or a nucleobase-binding group;

$R^{13}$  is a conjugate; and

a is 0 or 1;

K is  $(CR^6R^7)_z$ ;

J is  $(CR^6R^7)_y$ ; wherein:

$R^6$  and  $R^7$  are independently hydrogen, a side chain of a naturally occurring alpha amino acid, ( $C_2-C_6$ ) alkyl, aryl, aralkyl, heteroaryl, hydroxy, ( $C_1-C_6$ ) alkoxy, ( $C_1-C_6$ ) alkylthio, a conjugate,  $NR^3R^4$  and  $SR^5$  or  $R^6$  and  $R^7$  taken together complete an alicyclic or heterocyclic system;

$R^3$  and  $R^4$  independently are hydrogen, a conjugate, ( $C_1-C_4$ ) alkyl, hydroxy- or alkoxy- or alkylthio-substituted ( $C_1-C_4$ ) alkyl, hydroxy, alkoxy, alkylthio or amino;

$R^5$  is hydrogen, a conjugate, ( $C_1-C_6$ )alkyl, hydroxy-, alkoxy-, or alkylthio- substituted ( $C_1-C_6$ )alkyl; each of  $y$  and  $z$  is zero or an integer from 1 to 10, the sum  $y + z$  being greater than 2 but not more than 10;

$l$  is an integer from 1 to 5; and

at least one of  $L$  and  $R^3$  comprises a conjugate selected from a reporter enzyme, a reporter molecule, a steroid, a carbohydrate, a terpene, a peptide, a protein, a phospholipid, a cell receptor binding molecule, a crosslinking agent, a water soluble vitamin, a lipid soluble vitamin, an RNA/DNA cleaving complex, a metal chelator, a porphyrin, an alkylator, or a polymeric compound selected from polymeric amines, polymeric glycols and polyethers;

wherein said conjugate optionally includes a linking moiety; and

wherein said group  $R^3$  is a conjugate.--

#### REMARKS

After entry of the proposed amendment, claims 1-6, 8-10, 12, 13, 15-20, 22-24, 30-33, and 37-49 will be pending in this patent application.

Claims 1 and 37 have been amended to specify preferred embodiments of the present invention, and to further distinguish their subject matter from the subject matter of claims pending in